Claims

[1] A porous organosilicate polymer composite prepared by heating an organic/inorganic hybrid polymer in which an organosilicate polymer is chemically bonded to a radial pore-forming polymer ended with a hydrolyzable alkoxysilyl group and used as a core molecule.

[2] The porous organosilicate polymer composite of claim 1, wherein the heating is carried out at 200 to 500°C .

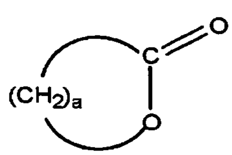
[3] The porous organosilicate polymer composite of claim 1, wherein the organosilicate polymer is chemically bonded to the radial pore-forming polymer by hydrolysis, dehydrolysis, and polycondensation.

[4] The porous organosilicate polymer composite of claim 1, wherein the hydrolyzable alkoxysilyl group of the radial pore-forming polymer is $-CONH-(CH_2)_3-Si(OC_2H_5)_3$, $-CH_2CH(CH_3)-CH_2O(CH_2)_3-Si(CH_3)_2(OC_2H_5)$, $-CH_2CH(OH)-CH_2O(CH_2)_3-Si(CH_3)(OC_2H_5)_2$, or $-CH_2CH(OH)-CH_2O(CH_2)_3-Si(CH_3)(OCH_3)_2$.

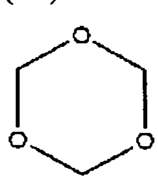
[5] The porous organosilicate polymer composite of claim 1, wherein the radial pore-forming polymer comprises a branch portion having the hydrolyzable alkoxysilyl group at an end and a central portion linked to the branch portion, and the central portion is formed by an ether selected from aliphatic ethers of C1-C30 and aromatic ethers of C6-C30.

[6] The porous organosilicate polymer composite of claim 5, wherein the central portion of the radial pore-forming polymer is formed using di(trimethylolpropane), di(pentaerythritol) or a derivative thereof having several end hydroxyl groups.

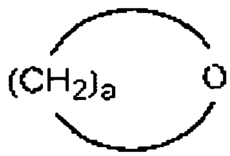
[7] The porous organosilicate polymer composite of claim 1, wherein the branch portion of the radial pore-forming polymer is prepared by ring-opening polymerization of one of cyclic compounds represented by Formulae 1A through 1D:



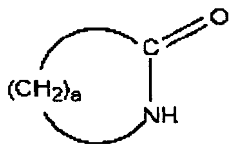
(1A)



(1B)



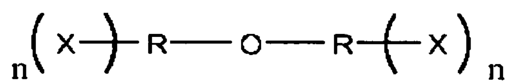
(1C)



(1D)

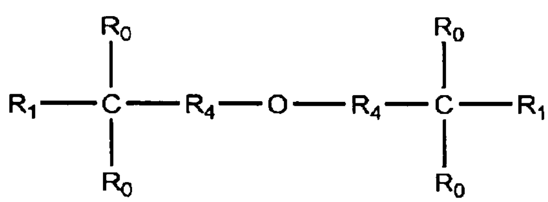
wherein a is 2 to 5.

[8] The porous organosilicate polymer composite of claim 1, wherein the radial pore-forming polymer has an ether structure with an end methoxysilane or ethoxysilane group represented by Formula 4:



wherein n is 2 to 64, R is derived from polyol, R-$(OH)_k$ where k ≥ 2, and X is an end functional group selected from -CONH-$(CH_2)_3$-Si$(OC_2H_5)_3$, -CH_2CH(CH_3)-CH_2O$(CH_2)_3$-Si$(CH_3)_2$(OC_2H_5), -CH_2CH(OH)-CH_2O$(CH_2)_3$-Si(CH_3)$(OC_2H_5)_2$ and -CH_2CH(OH)-CH_2O$(CH_2)_3$-Si(CH_3)$(OCH_3)_2$.

[9] The porous organosilicate polymer composite of claim 8, wherein the radial pore-forming polymer is represented by the following Formula 5:

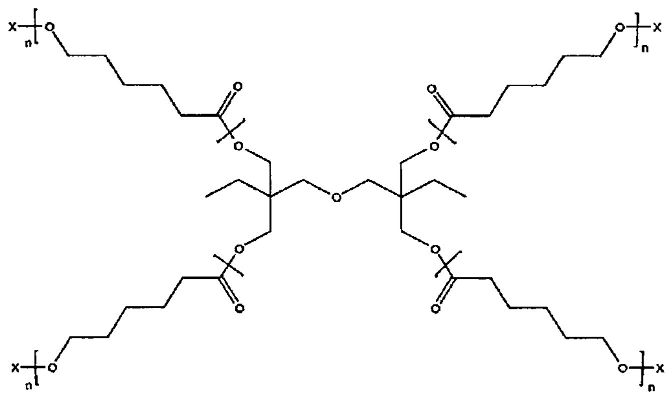


wherein R_0 is -CH_2O-[CO-$(CH_2)_5$-O$]_a$-X and R_1 is -C_2H_5 or -CH_2O-[CO-$(CH_2)_5$-O$]_a$-X where X is a substituent selected from -OCONH-$(CH_2)_3$-Si$(OC_2H_5)_3$, -OCH_2CH(CH_3)-CH_2O$(CH_2)_3$-Si$(CH_3)_2$(OC_2H_5), -OCH_2CH(OH)-CH_2O$(CH_2)_3$-Si(CH_3)$(OC_2H_5)_2$, and -OCH_2CH(OH)-CH_2O$(CH_2)_3$-Si(CH_3)$(OCH_3)_2$ and a is 2 to 20, and R_4 is a substituted or unsubstituted alkylene group of C1-C30 or a substituted or unsubstituted arylene group of C6-C30.

[10] The porous organosilicate polymer composite of claim 1, wherein the organosilicate polymer is selected from the group consisting of methyl silsesquioxene, ethyl silsesquioxene, and hydrogen silsesquioxene.

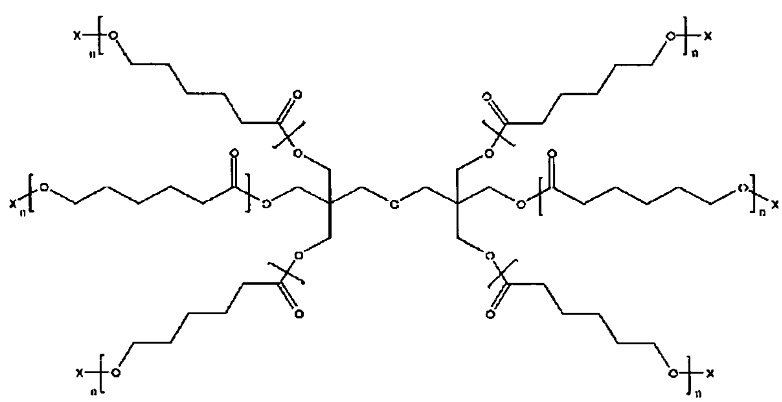
[11] The porous organosilicate polymer composite of claim 1, wherein the organosilicate polymer is obtained by hydrolysis, dehydrolysis, and polycondensation of one or more silane compounds, and the silane compounds are selected from the group consisting of trichlorosilane, methyltriethoxysilane, methyltrimethoxysilane, methyldiethoxysilane, methyldimethoxysilane, ethyltriethoxysilane, ethyltrimethoxysilane, ethyldiethoxysilane, ethyldimethoxysilane, bistrimethoxysilylethane, bistriethoxysilylethane, bistriethoxysilylmethane, bistriethoxysilyloctane and bistrimethoxy silylhexane.

[12] The porous organosilicate polymer composite of claim 1, wherein the radial pore-forming polymer is represented by Formula 2:



wherein X is $-CONH-(CH_2)_3-Si(OC_2H_5)_3$, $-CH_2CH(CH_3)-CH_2O(CH_2)_3-Si(CH_3)_2(OC_2H_5)$, $-CH_2CH(OH)-CH_2O(CH_2)_3-Si(CH_3)(OC_2H_5)_2$ or $-CH_2CH(OH)-CH_2O(CH_2)_3-Si(CH_3)(OCH_3)_2$, and n is 2 to 20.

[13] The porous organosilicate polymer composite of claim 1, wherein the radial pore-forming polymer is represented by Formula 3:



wherein X is $-CONH-(CH_2)_3-Si(OC_2H_5)_3$, $-CH_2CH(CH_3)-CH_2O(CH_2)_3-Si(CH_3)_2(OC_2H_5)$, $-CH_2CH(OH)-CH_2O(CH_2)_3-Si(CH_3)(OC_2H_5)_2$ or $-CH_2CH(OH)-CH_2O(CH_2)_3-Si(CH_3)(OCH_3)_2$, and n is 2 to 20.

[14] The porous organosilicate polymer composite of claim 1, wherein the radial pore-forming polymer has a weight average molecular weight of 500-20,000 g/mol and the organosilicate polymer has a weight average molecular weight of 3,000-20,000 g/mol.

[15] The porous organosilicate polymer composite of claim 1, wherein the organic/inorganic hybrid polymer has a weight average molecular weight of 3,000 to 100,000 g/mol.

[16] The porous organosilicate polymer composite of claim 1, wherein the radial pore-forming polymer is 1 to 50 wt% and the organosilicate polymer is 50 to 99 wt%.

[17] A semiconductor device using an organosilicate polymer composite film comprising the porous organosilicate polymer composite of any one of claims 1 through 16.

[18] The semiconductor device of claim 17, wherein the organosilicate polymer composite film has a dielectric constant of 1.40 to 2.00.